the success in treating disease they were expected to be are probably too poor in complement, though they may contain plenty of the immune body.

Quite distinct from the bactericidal, globulicidal and antitoxic properties of blood is its agglutinating action. This is another result of infection with many kinds of bacteria or their toxins. The blood acquires the property of rendering immobile and clumping together the specific bacteria used in the infection. The test applied to the blood in cases of typhoid fever, and generally called Widal's reaction, depends on this fact.

The substances that produce this effect are called *agglutinins*. They also are probably proteid-like in nature, but are more resistant to heat than the lysins. Prolonged heating to over 60° C. is necessary to destroy their activity.

Lastly, we come to a question which more directly appeals to the physiologist than the preceding, because experiments in relation to immunity have furnished us with what has hitherto been lacking, a means of distinguishing human blood from the blood of other animals.

The discovery was made by Tchistovitch (1899), and his original experiment was as follows :—Rabbits, dogs, goats and guinea-pigs were inoculated with eel-serum, which is toxic; he thereby obtained from these animals an antitoxic serum. But the serum was not only antitoxic, but produced a precipitate when added to eel-serum, but not when added to the serum of any other animal. In other words, not only has a specific antitoxin been produced, but also a specific *precipitin*. Numerous observers have since found that this is a general rule throughout the animal kingdom, including man. If, for instance, a rabbit is treated with human blood, the serum ultimately obtained from the rabbit contains a specific precipitin for human blood; that is to say, a precipitate is formed on adding such a rabbit's serum to human blood, but not when added to the blood of any other animal.[1] The great value of the test is its delicacy; it will detect the specific blood when it is greatly diluted, after it has been dried for weeks, or even when it is mixed with the blood of other animals.

I have entered into this subject at some length, because it so admirably illustrates the kind of research which is now in progress; it is also of interest to others than mere physiologists. I have not by any means exhausted the subject, but for fear I may exhaust my audience let me hasten to a conclusion. I began by eulogising the progress of the branch of science on which I have elected to speak to you. Let me conclude with a word of warning on the danger of over-specialisation. The ultra-specialist is apt to become narrow, to confine himself so closely to his own groove that he forgets to notice what is occurring in the parallel and intercrossing grooves of others. But those who devote themselves to the chemical side of physiology run but little danger of this evil. The subject cannot be studied apart from other branches of physiology, so closely are both branches and roots intertwined. As an illustration of this, may I be permitted to speak of some of my own work? During the past few years the energies of my laboratory have been devoted to investigations on the chemical side of nervous activity, and I have had the advantage of cooperating to this end with a number of investigators, of whom I may particularly mention Dr. Mott and Dr. T. G. Brodie. But we soon found that any narrow investigation of the chemical properties of nervous matter and the changes this undergoes during life and after death was impossible. Our work extended in a pathological direction so as to investigate the matter in the brains of those suffering from nervous disease; it extended in a histological direction so as to determine the chemical meaning of various staining reactions presented by normal and abnormal structures in the brain and spinal cord; it extended in an experimental direction in the elucidation of the phenomena of fatigue, and to ascertain whether there was any difference in medullated and non-medullated nerve fibres in this respect; it extended into what one may call a pharmacological direction in the investigation of the action of the poisonous products of the breakdown of nervous tissues. I think I have said enough to show you how intimate are the connections of the chemical with the other aspects of physiology, and although I have given you but one instance, that which is freshest to my mind, the same could be said for almost any other well-planned piece of research work of a bio-chemical nature.

[1] There may be a slight reaction with the blood of allied animals; for instance, with monkey's blood in the case of man.

We have now before us the real work of the Section, the reading, hearing and seeing the researches which will be brought forward by members of the Association, and I must, in thanking you for your attention, apologise for the length of time I have kept you from these more important matters.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

IT is recommended by Mr. Herbert Welsh, of Philadelphia, who was largely instrumental in raising the Wilson endowment fund, value 100,000 dollars, of the Washington and Lee University, that a fund of 500,000 dollars be raised to endow a scientific and technical school for the University.

THE papers read at the conference of science teachers held at the Hartley University College, Southampton, to which attention was directed in our issue of June 19, 1902, have now been published in book form. The title of the little volume is "Science Teaching and Nature Study." Copies may be obtained from Mr. H. M. Gilbert, Above Bar, Southampton, price 6*d*. each.

THE following courses of lectures on advanced physiology are announced for delivery in the physiological laboratory at the buildings of the University of London during the coming term :—(*a*) "On the Sources of Animal Energy," by Prof. E. H. Starling, on Tuesdays, October 14, 21, 28, November 4, 11, 18, 25, December 2, at 5 p.m.; (*b*) "On Animal Heat and Respiration," by Dr. M. S. Pembrey, on Wednesdays, October 15, 22, 29, November 5, 12, 19, 26, December 3, at 5 p.m. The lectures, admission to which is free, are addressed to advanced students, and are arranged to meet the requirements of candidates for honours in physiology at the University. Cards of admission may be obtained on application to the Academic Registrar, at the University Buildings, South Kensington, S.W.

SCIENTIFIC SERIALS.

Journal of Botany, September.—Under the title of "Alabastra diversa," Mr. Spencer le M. Moore continues his account of new plants. *Amphoranthus spinosus*, from Damaraland, furnishes a new genus of the suborder Cæsalpinieæ, approximating to the existing genus Cordyla. Five new species are added to the Acanthaceæ. A note by the same writer refers to the plant which, under the name of *Haemacanthus coccineus*, was described in a previous number of the *Journal* as a new genus; there is some possibility of this proving to be identical with the plant named *Satanocrater coccineus* by Dr. Lindau.—Dr. Rendle describes two new varieties of orchids from China, and a new species of Burmannia from the same country. The latter is figured along with Amphoranthus.—Two papers deal with the genus Hieracium; in the first, Mr. H. J. Riddelsdell gives a list of Welsh Hieracia; in the second, Mr. F. N. Williams, in the course of his remarks on the "Salient Features in Hieracium," alludes to the difference between the characters emphasised by Scandinavian and Continental botanists, and points out the importance of the hairs, the structure of the receptacle and the stem branching as distinguishing morphological features.—Messrs. R. E. and F. Cundall contribute a list of Glamorganshire plants which furnishes a supplement to that published recently by Messrs. Marshall and Shoolbred.—The article entitled "Botany in England a Century Ago" gives the impressions of Dr. H. A. Noehden formed during his visit to this country in the year 1799.

The American Journal of Science, September.—The relationships of some American and Old World birches, by M. L. Fernald.—On the fertile fronds of Crossotheca and Myriotheca, and on the spores of other Carboniferous ferns from Mazon Creek, Illinois, by E. H. Sellards.—On the validity of *Idiophyllum rotundiflorum*, Lesquereux, a fossil plant from the Coal-measures of Mazon Creek, Illinois, by E. H. Sellards. It

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is shown that the species *Idiophyllum rotundiflorum* is a synonym of *Neuropteris rarinervis*, and that the genus Idiophyllum has no status in fossil botany.—The precipitation of ammonium vanadate by ammonium choride, by F. A. Gooch and R. D. Gilbert. Previous work on the separation of vanadium as ammonium metavanadate by means of ammonium chloride having led to contradictory results, the method has been exhaustively re-examined, with the result that under suitable conditions, easily realised experimentally, the determination by Gibbs's method is accurate.—Some additions to the alunite-jarosite group of minerals, by W. F. Hillebrand and S. L. Penfield.—The Niagara limestones of Hamilton County, Indiana, by Edward M. Kindle.—On the velocity and the structure of the nucleus, by C. Barus.—Note on corundum and a graphitic essonite from Barkhampstead, Connecticut, by B. K. Emerson.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 22.—M. Bouquet de la Grye in the chair.—The president announced to the Academy the loss it had sustained by the death of M. Damour.—The extension of Fermat's principle on the economy of time to the relative movement of light in a transparent homogeneous body subject to a rapid translation, by M. J. Boussinesq. It is shown that the principle of least time as enunciated by Fermat applies to the case of a body subjected to a rapid translatory motion. Polarisation is also unaffected.—The enclosures in the andesites from Mont Pelée, by M. A. Lacroix. The enclosures contain a greenish or yellowish-grey rock of a microlitic character; the mineralogical composition is always the same qualitatively, but the proportion of the elements varies considerably. The most complete type contains plagioclases, hypersthene, augite, titanomagnetite, hornblende and olivine. These enclosures are not fragments of solid rock torn off from the depths of the volcano, there being abundant evidence that they have been formed in place. They greatly resemble certain nodules of hypersthene-andesite from the last eruption of Santorin.—Spectral researches on the rotation of the planet Uranus, by M. H. Deslandres. The first researches on the rotation of the planets have been made by simply measuring the movement of certain well-defined points; if the image is uniform and without detail, this method fails. On account of the small apparent diameter and feeble lustre of Neptune and Uranus, their time of rotation has hitherto remained undetermined. A new mode of attacking this problem is by applying the Döppler-Fizeau principle. This was first applied successfully to the Sun in 1889, to Jupiter and Saturn in 1895, and to Venus in 1900. The same method in a modified form has now been applied to Uranus, with the result that it is very probable that this planet turns in a retrograde sense, like its satellites. To obtain more definite measurements, further researches must be carried out in observatories nearer the equator, with more powerful instruments and in a very calm atmosphere, and for a period of twenty-one years. Encouraging results have also been obtained by the application of the same method to the planet Neptune.—On the combinations of silicon with cobalt, and on a new silicide of this metal, by M. P. Lebeau. When cobalt is heated in the presence of an excess of fused silicon, or when a mixture of silicide of copper, cobalt and silicon is submitted to the temperature of the electric furnace, a well-crystallised cobalt silicide of the composition Si_2Co is formed, the physical properties and chemical reactions of which are given in detail. Cobalt thus forms three definite crystalline compounds with silicon, having the formulæ $SiCo_2$, SiCo and Si_2Co, these compounds forming a series in all respects comparable with the silicides of iron.—On the calorific power of coal, by M. Goutal. By an examination of 600 specimens of coal of different kinds, the calorific value (P) is found to be given, with an approximation of 1 per cent., by the formula $P = 82\,C + a\,V$, in which C is the percentage of ash-free coke, V the volatile matter, and a a coefficient, a curve for the determination of which is given in the paper. The error may amount to 2 per cent. of the calorific value in the case of anthracite and some lignites.—On the existence of stable yeast forms in some moulds, by M. G. Odin.—On a modification produced in *Scopolia carnolica* following its grafting on the tomato, by M. Lucien Daniel.

NEW SOUTH WALES.

Royal Society, August 6.—Prof. Warren, president, in the chair.—On the mitigation of floods in the Hunter River, by Mr. J. H. Maiden. The paper discusses the subject from the point of view of the forester.

CONTENTS.

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